Appendix F

Specific Groundwater Model comments

1. Page 4, Section 1.2.1 Approach to Estimating Groundwater Discharge, first bullet. The sixth sentence indicates that upland hydraulic properties were calibrated to match seepage rates. The intention of the work plan was to characterize discharge to the creek through a number of different methods, then evaluate and discuss the differences to arrive at the best estimate based on multiple lines of evidence. Discuss conclusions regarding why seepage rates might differ from upland property estimates should be discussed. Perhaps the seepage rates in some segment groups should be calibrated to upland hydraulic properties.

2. Page 5, Section 1.2.2 Approach to Estimating Chemical Loads, second/middle paragraph. It states: "Due to the protracted history of industrial development…the locations of elevated TPAH, TPCB, and Cu concentrations…cannot be definitively linked to proximate sites." This needs to be demonstrated through systematic comparison between Study Area water quality and sediment contamination data and the data from upland sites, to determine if there are statistically significant correlations. Revise the document accordingly.

3. Page 16, Section 3.5.2 Upland data. There appears to be a wide range of hydraulic conductivity values both from slug tests and pumping tests. Slug tests are subject to well effects, therefore estimates from pumping tests should generally be considered more reliable. The range of values suggest that wells were screened in very different formation material. Add a discussion of the relative portions of the different materials in the soil column to either the use of arithmetic averaging or a more representative distribution of the hydraulic conductivities.

4. Page 17, Section 3.5.3.1 Slug Tests, third paragraph, second sentence. 4.1 x 10-5 centimeters per second (cm/sec) is equivalent to 0.11 foot/day, not 1.1 feet/day. Revise accordingly.

5. Page 28, Section 3.7.2.1.1 Sensitivity Analysis, last paragraph. Incorporate the impacts of NAPL presence; include the range of results from the least to most conservative. It is currently unclear in the text why all three methods are presented while the results of the more conservative methods are discounted entirely.

6. Page 39, Section 4.3.1.1 Groundwater Withdrawal, first full paragraph. The base flow rate for predevelopment conditions needs to be increased significantly, due to a misinterpretation of the modeling results in the cited United States Geological Survey (USGS) modeling report (Misut and Monti, 1999). Thus, the current condition base flow rate also needs to be increased significantly because the water table has rebounded to predevelopment levels, except for the zones that are being controlled by remediation pumping.

   The misinterpretation of the USGS modeling results can be explained through examination of Figures 5 and 7 on pages 14 and 16 of the USGS report. Figure 7 shows the seven model cells that the USGS simulated as "stream" boundary cells, while Figure 5 displays the boundary cells for representing the mean sea level shoreline. Figure 5 shows that the USGS simulated the Study Area with the shoreline boundary condition, whereas the Figure 7 stream cells were placed only further inland to represent an upland drainage channel that is apparently now gone. Therefore, the predevelopment base flow in Table 3 on page 9 of the USGS report represents only the simulated groundwater discharge to those seven upland stream cells. The USGS report does not separately tabulate the groundwater discharge rate to the shoreline boundary cells that simulate the Study Area; however, the groundwater discharge to those shoreline Study Area cells must be significantly higher than the 2.5 cubic feet per second (1.6 million gallons per day [MGD]) simulated base flow to the upland stream cells. This is because the contributing area is on the order of 10 to 15 square miles based on the water table contour map shown on Figure 3A on page 10 of the USGS report (which is roughly the same as the RI report's PGCA), and the USGS-simulated net recharge rate in Queens and Brooklyn was 160 MGD (Table 2 on page 9 of the USGS report) across an area of about 150 square miles (or approximately 1.1 MGD per square mile). Because other outflows were negligible during predevelopment, this means that the USGS-simulated groundwater discharge to the Study Area was about 11 to 16 MGD for predevelopment conditions. Given that the USGS reduced the simulated recharge to the water table to 136 MGD for representing 1983 conditions (Table 2 on page 9 of the USGS report), the equivalent predevelopment Study Area groundwater recharge rate would be approximately 9 to 13 MGD. Further, given that the current water table contour map is very similar to the predevelopment map shown in Figure 3A of the USGS report, the current base flow to the Study Area must be very similar to the 9 to 13 MGD. If the 1.6 MGD simulated as predevelopment "stream" base flow by the USGS is also accounted for, the current total base flow to the Study Area would total to 11.6 to 14.6 MGD before accounting for other discharges.

Revise accordingly.

7. Page 41, Section 4.5.2.2 Loss to Sewer pipes, second paragraph. This section references a Greeley and Hansen 1982 report for the estimate of infiltration to sewers in the PGCA, based on reported extraneous flow. There appears to be subsequent reports, including a 1993 Newtown Creek Water Quality Facility Planning. Project, Task 3.0 Sewer System Evaluation Survey and a 2011 Waterbody/Watershed Facility Plan that indicate extraneous flow is a result of other factors and that infiltration is much lower. Resolve this difference as it has significant implications to the water balance presented in Section 5 of Appendix F (5.1.2 Outflow).

8. Page 49, Section 5.1.2.2 Dewatering: The Metropolitan Transportation Authority (MTA) indicated (through correspondence with EPA) that the only dewatering within the subway lines is through "muck trenches" located directly underneath the rails. These muck trenches drain infiltrating groundwater by gravity to nearby Pump Rooms, where the collected water is then pumped to sewers. Because of time limitations cited by MTA personnel associated with accessing files, EPA requested that MTA calculate the amount of pumping from approximately half of the pump rooms within the PGCA. The locations were selected to be representative of the full set of stations throughout and just beyond the edges of the PGCA. The stations are representative of hydrologic conditions for the full set of stations, including

locations where the subway tubes and stations intersect or are below the water table, as well as above the water table. Information collected included key stations near the downstream portion of the Study Area, given the USGS seepage meter result there that produced some very large negative values.

The total dewatering rate based on half of the stations was 0.03 MGD. There is also one deep well within the PGCA (Maspeth Deep Well) that was historically used for dewatering EPA's contact at MTA (Francine Ocampo) has indicated that this well is no longer operating. Thus, the pumping rate from all MTA subway facilities in the PGCA can be estimated to be 0.06 MGD. Revise accordingly.

9. Page 51, Section 5.1.3 Tier 1 Results. Correcting for much lower loss of groundwater and potentially higher precipitation infiltration reverses the conclusion of net negative groundwater flow into the Study Area. Incorporate this revision throughout the report main text and Appendix F, and any other passages that cite this conclusion – as well as during planning and implementation of FS stage field data collection, modeling, and interpretation of results.

10. 51 to 60, Section 5.2 Tier 2 Analysis of Segment Groups. Regarding the overall approach, incorporate consideration of the potentially significant amount of (very) shallow seepage and a non-uniform distribution laterally from shoreline to shoreline. Conduct cross-sectional numerical modeling to improve the conceptual understanding in this regard. In addition, perform such modeling in support of the planning and implementation of FS stage field data-collection, modeling, and results interpretation.

11. Pages 51 to 60, Section 5.2 Tier 2 Analysis of Segment Groups. Back-calculated net recharge rates, which appear not to be discussed, range widely from Segment to Segment, with at least one of the Segment's rate (40+ inches/year) well beyond a reasonable upper limit, and another one (approximately 16 inches/year) being the only one near the County-wide average rates for Brooklyn and Queens as simulated by the USGS (Misut and Monti, 1999). All the other back-calculated net recharge rates are very low (generally 3 inches/year or less) and thus well below the County-wide averages. Similarly, the back-calculated transmissivity and hydraulic conductivity values range widely from Segment to Segment, and the spatial variation of the back-calculated values has not been linked to changes in the geologic sediments' characteristics or to Segment-specific hydraulic testing data on a Segment-by-Segment basis. In addition, there are very abrupt differences going from Segment to Segment, with examples of this in the back-calculated values for net recharge and hydraulic properties (transmissivity and hydraulic conductivity), yet without substantiation for the abruptness. The very wide range of back-calculated values and the abrupt changes from Segment-to-Segment demonstrate the need for an improved conceptual model of groundwater seepage as part of FS stage supplemental data-collection, data evaluation, and modeling. Revise accordingly.

12. Pages 53 and 54, Section 5.2.1 Calculation of Seepage Rates from Long-Term Monitoring Data, final 2 paragraphs. The estimated anisotropy ratio for native sediments ranging from 1 to 3 is well below values typically used in representing (modeling) such sediments. The USGS report (Prince and Schneider, 1989) cited as the basis for this estimated range

actually includes information contradicting a high end of 3:1, as follows: (a) The report's Table 1 cites other USGS studies that produced values as high as 16:1 to 24:1 on the high end; and (b) the authors' own field testing and data evaluations produced ratios as high as 6.5:1. Later USGS efforts, which are cited for other information in this RI report, included numerical modeling studies in which anisotropy ratios of 10:1 were simulated (Misut and Monti, 1999, for example). Moreover, even higher anisotropy ratios should be assumed for the native riverine sediments of the Study Area, because of stronger stratification effects. This indicates that the evaluation of horizontal hydraulic conductivity results from analysis of recently conducted RI stage slug testing have produced estimates of vertical hydraulic conductivity that are significantly too high. Thus, the basic conceptual model for groundwater discharge into the Study Area needs to be re-examined. Along all shoreline segments, a significantly lower vertical hydraulic conductivity within the Study Area footprint would focus more groundwater flow to seep out laterally and/or discharge very locally right along the shoreline. In addition, where saltwater intrusion is a factor, the saline groundwater wedge would enhance this effect. As indicated in other comments for Appendix F, numerical cross-sectional modeling is needed, to conduct conceptual model hypothesis-testing and sensitivity analyses for improving the conceptual model understanding, and thereby, to help guide the planning and implementation of FS stage field data collection and modeling – toward a defensible, technically-sound interpretation of groundwater seepage into the Study Area. Revise accordingly.

13. Page 55, Section 5.2.2 Interpolation of Seepage Rate on Model Grid, final paragraph. EPA fully supports collecting more data to improve the understanding of groundwater seepage spatial distribution, the range of seepage rates, as well as the chemical concentrations in such seepage. Incorporate this new data into calculations and modeling activities/documentation once it is available.

14. Page 59, Section 5.2.6.1 Segment Groups C and K, both paragraphs. Augment the conclusion that induced infiltration predominates in Segment Groups C and K by providing salinity and/or specific conductivity data from sampling of the remediation pumping wells. Because the estimated rate of induced infiltration is roughly half of the total remediation pumping rate, and assuming steady state hydraulic conditions have been in effect for many years, the salinity and specific conductivity of the pumped groundwater should be significantly impacted by the amount of surface water induced into the local groundwater flow system. Similarly, the groundwater along induced infiltration flow pathways from the Study Area to the remediation pumping wells should have been showing increased salinity and specific conductivity.

15. Pages 65 to 67, Section 6 Chemical Load Estimates, 5th through final paragraphs. It is very important and significant to note that if NAPL affected the measured groundwater concentrations, this does not mean that the groundwater loading triggered by groundwater seepage is biased high. Without definitively identifying the source of the NAPL, the source could be from upland sites either via subsurface transport or riverine sedimentation. This accentuates the need for evaluating potential sources systematically (as indicated in a prior comment), and it also emphasizes the need for improving the characterization of the effects of NAPL during the FS stage. Revise the RI accordingly.

16. Pages 68 through 74, Section 7 Sensitivity Analysis, all portions. Postpone sensitivity analyses regarding groundwater seepage impacts until the FS stages because of the need to collect additional data and improve the conceptual model understanding, which is anticipated to lead to significant improvements in simulating the spatial distribution of groundwater seepage and the rates of flow and COPC mass discharge into the Study Area. In addition, prior to conducting FS stage sensitivity analyses, the analyses need to be discussed in detail, including the identification of parameters to adjust, the setting of parameter ranges, and the criteria/metrics used for interpreting the results. Revise accordingly.